



*Photo by Doug Raflik*



*WWA is a non-profit organization dedicated to the protection, restoration, and enjoyment of wetlands and their associated ecosystems through science-based programs, education, and advocacy.*



*Photo by Frank Koshere*

# Purple Loosestrife Workshop

- Background information on purple loosestrife (PL)
  - **Occurrence in Wisconsin Wetlands**
- Conducting a PL survey
- Background on biocontrol of PL
- How to conduct your own biocontrol project





# How are wetlands defined?

1. Soils: hydric
2. Vegetation: wetland plants
3. Hydrology: regular periods of inundation or saturation

*Wisconsin has a diversity of wetlands including marshes, swamps, wet meadows, bogs, and fens*



# Value of Wetlands

A photograph of a wetland landscape. In the foreground, there are large, round green lily pads floating on the water. Tall, thin reeds or grasses are scattered throughout the scene. The water is a deep blue-green color. In the background, there is a dark, silhouetted line of trees or land under a bright blue sky with some light clouds.

*Wetlands are beautiful,  
magical parts of our  
landscapes.*

*Wetlands provide  
services to our  
communities.*

# Threats to Wetlands



**agriculture**



**suburban  
development**

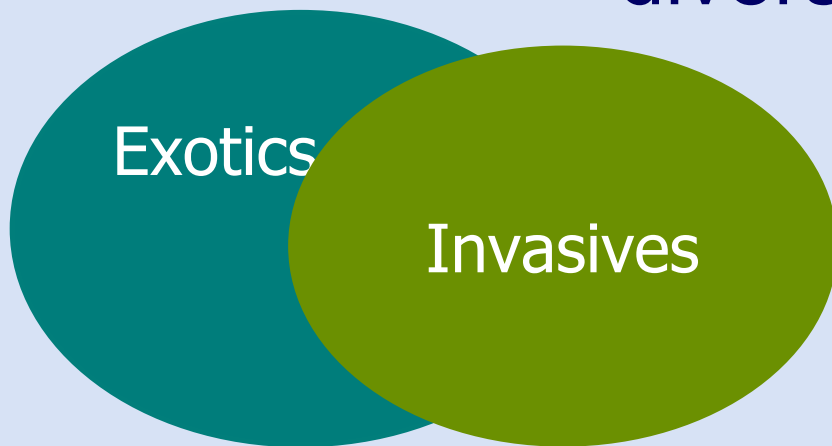


**invasive species**

# Exotic and invasive species

Exotic: not native to a given area or ecosystem

Invasive: spreads rampantly, crowds out native species and degrades the quality or diversity of an ecosystem



# Background information on PL





# Global PL distribution



Native range

Introduced range

# PL in European wetlands



Find the purple loosestrife!

# Roadside PL in the Czech Rep.

- Small plant size and number is typical--
- The result of over 100 insect species that prey on PL there
- Diseases may also be important in natural control of the plant



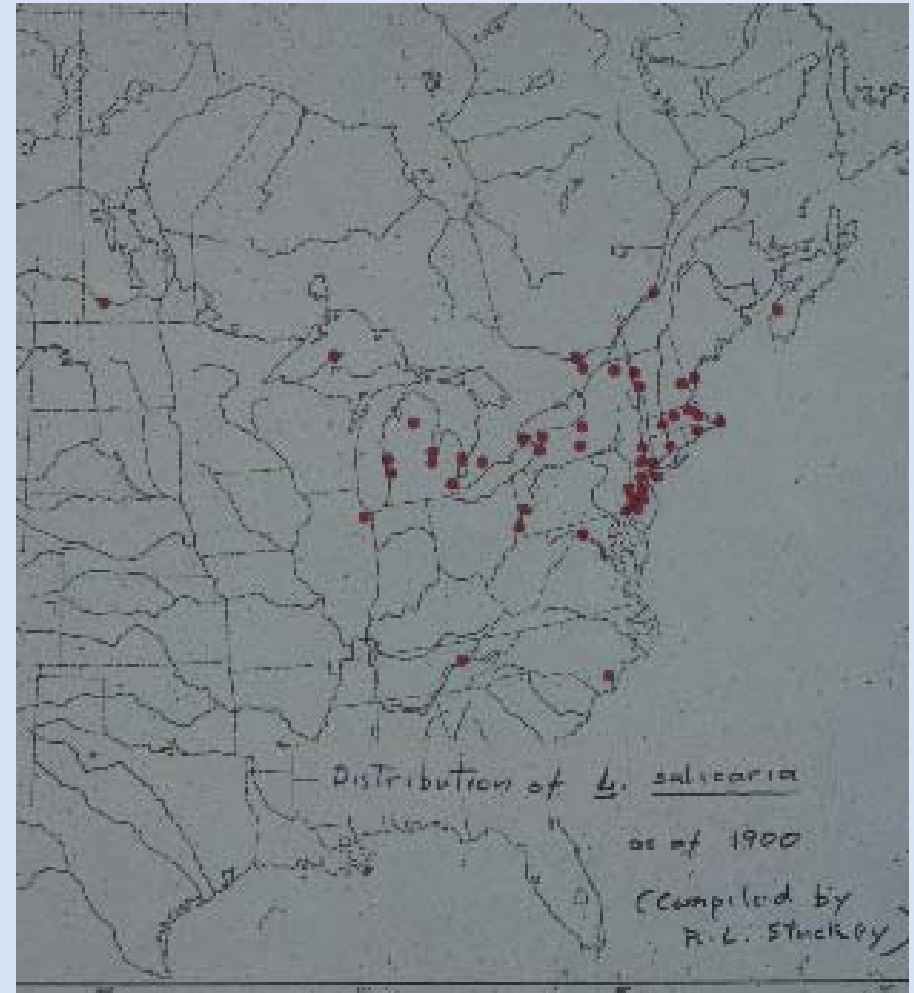
# Why is PL a big problem in North America?

#1. PL is being spread throughout the continent very rapidly due to large amounts of small seed produced and rapid natural and human movement

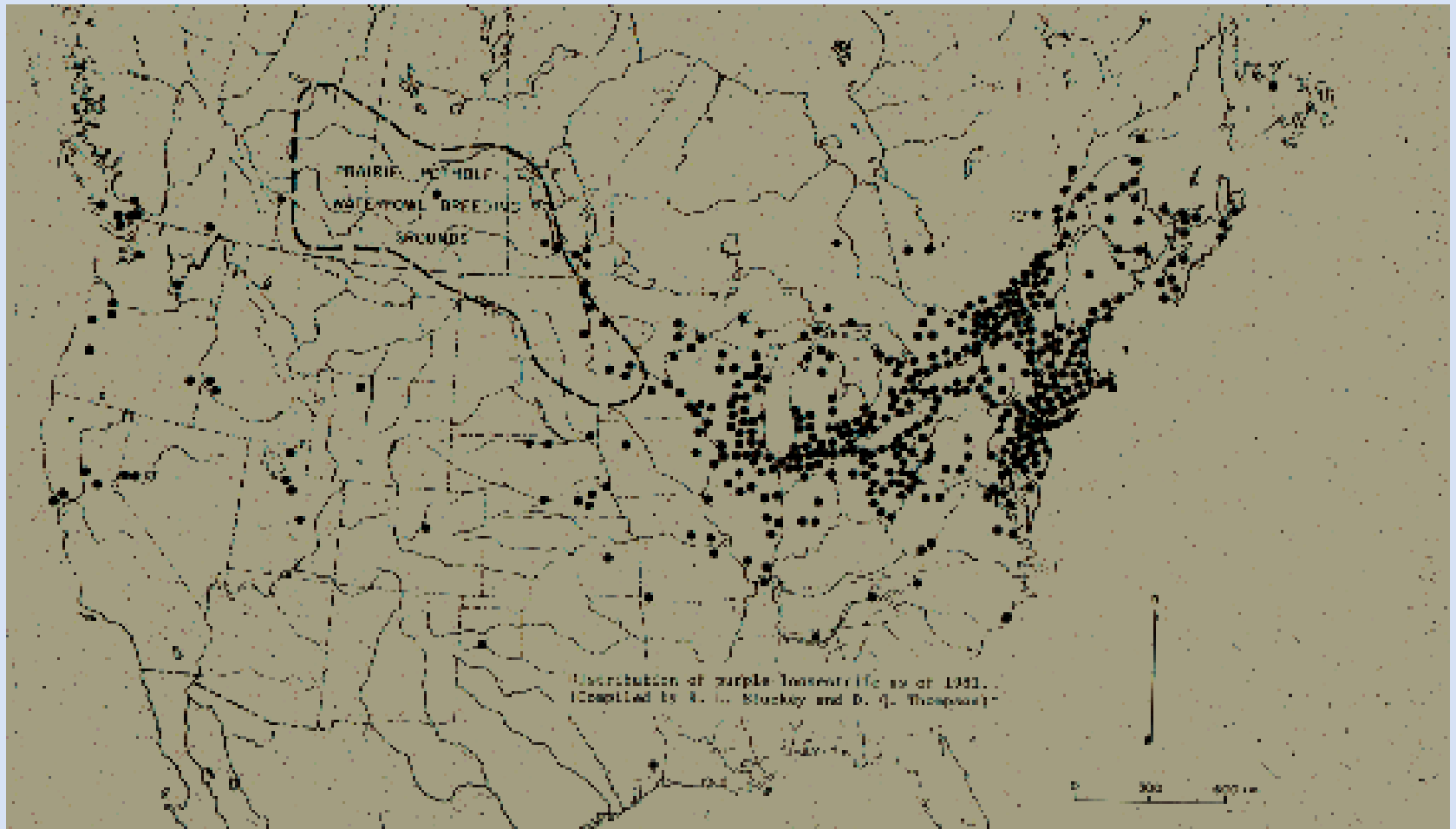


# PL spread in N. America by 1900

- PL arrived on the NE coast and spread to the Great Lakes in ship ballast
- Gardeners, bee keepers and natural means spread the plant into many additional locations

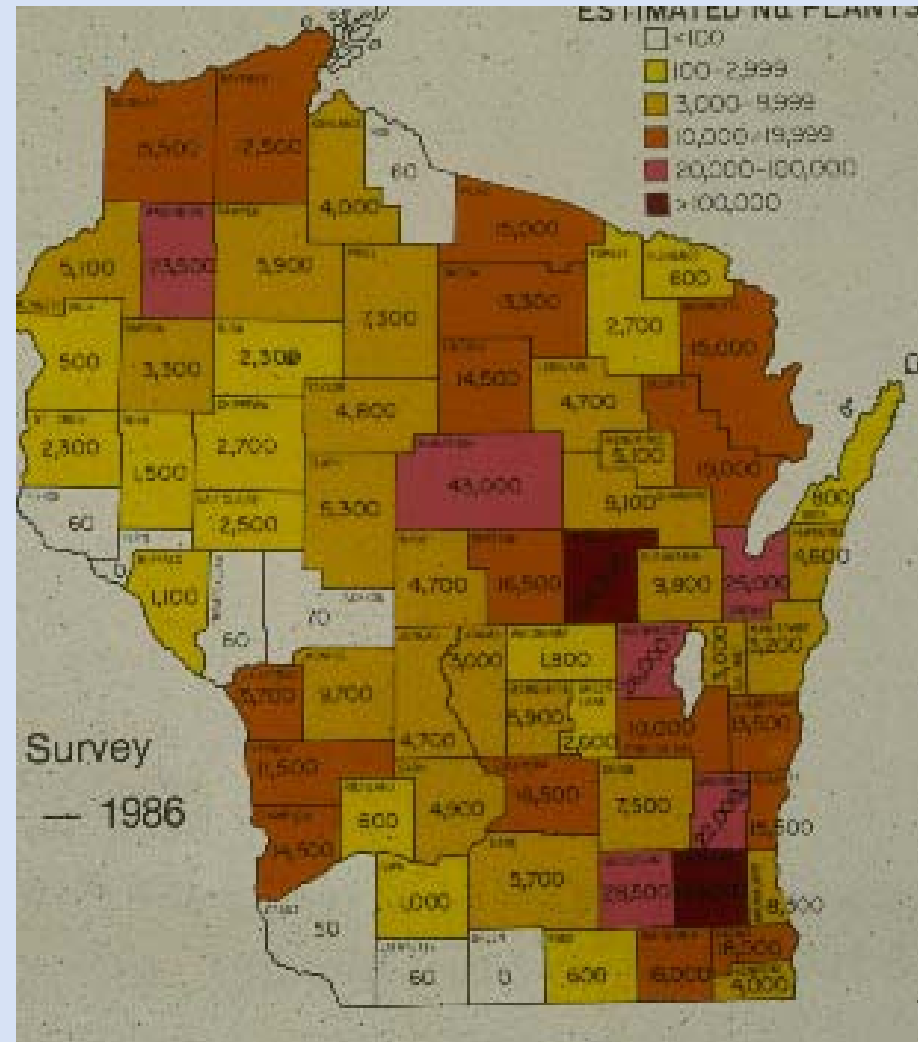


# PL Spread in N. America by 1981



# PL in Wisconsin by 1988

- This is the only relatively complete survey of the whole state to date
- A new survey has begun, spearheaded by the Wisconsin Wetlands Association



# Dispersal by nature

## Water

## Birds





# Dispersal along highways

US Hwy 41 at Oshkosh



# Why is PL a big problem in North America?

#2. Purple loosestrife dominates  
and displaces native wetland  
vegetation, decreasing native  
biodiversity

# Importance of biodiversity

**Monoculture**



**Diverse Ecosystem**



# Impacts of PL on native biodiversity

- Crowds out native wetland plants
- Homogenizes habitat – few niches for insects, birds, etc.
- Reduces food resources available to wildlife





# Impacts of PL on recreation

- Reduced access to waterways
- Habitat & biodiversity loss = ↓ opportunities for:
  - birdwatching
  - fishing/hunting



# Identifying PL



# Purple Loosestrife

## *Lythrum salicaria*



- Perennial – stems die back in winter
- Grow in clumps of several to many stems
- Commonly 6' - 8' tall



# Purple Loosestrife Flowers



1. Magenta or purple stalk, often more than 1' long
2. Flowers  $\frac{3}{4}$ " across
3. 5 or 6 petals per flower



Photo courtesy Luke Skinner, MN DNR

# Stems & Leaves



1. Stems square or 5- or 6-sided
2. Leaves opposite, pairs offset 90°
3. Leaves downy underneath





# PL Look-alike #1: Fireweed



- Long seed pods that reach up like arms
- 4 petals per flower
- Habitat: drier soils

# PL Look-alike #2: Blue Vervain



Very tiny flowers on  
pencil-thin spikes

# PL Look-alike #3: Winged Loosestrife

1. *Lythrum alatum*
2. Smaller flowers
3. Flowers single in leaf axils, not on spikes
4. Shorter than PL, only 1' to 4'



# PL Look-alike #4: Water Willow

1. Close relative of PL
2. Stems lean over instead of standing upright
3. Flowers in leaf axils, not in spikes





# PL Look-alike #5: Dame's Rocket



1. Also an exotic, invasive species, which should not be grown in Wisconsin
2. 4-petaled flowers not spiked
3. Blooms in spring

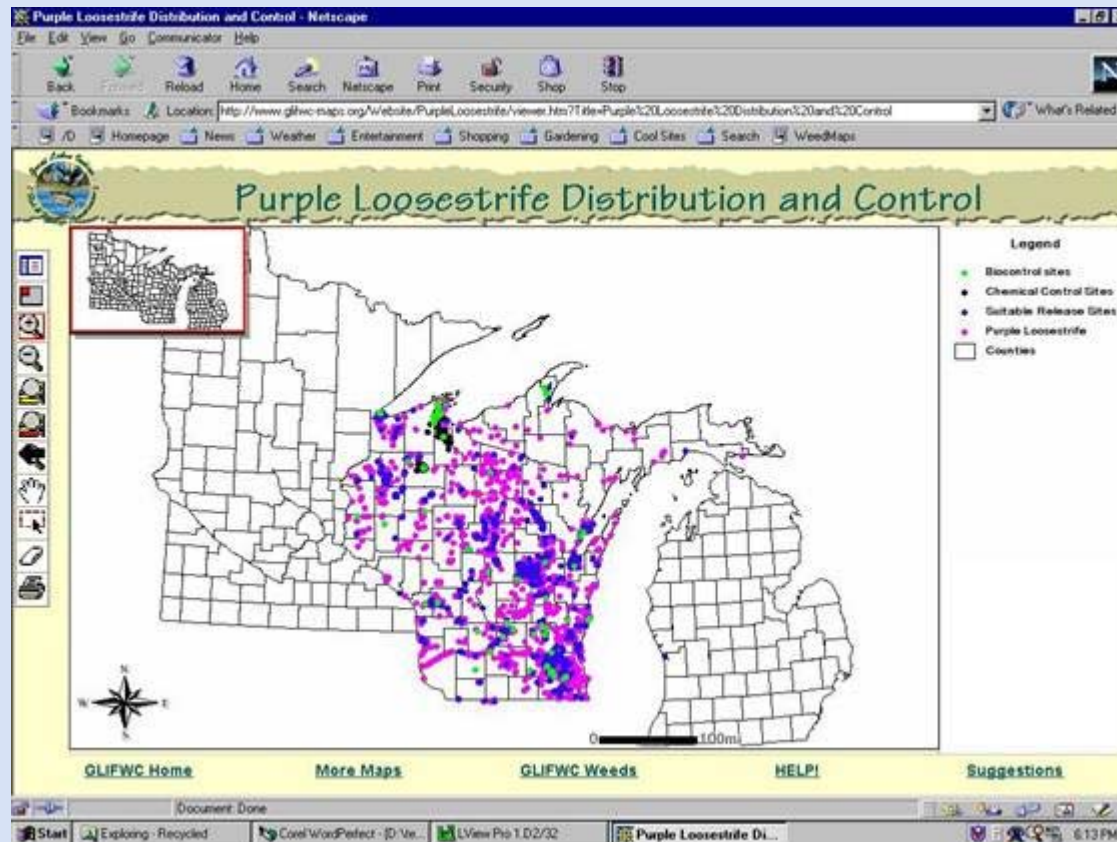


# Wisconsin Wetland Association's Purple Loosestrife Survey Program



A cooperative venture of WWA,  
WDNR, and Wisconsin Citizens!

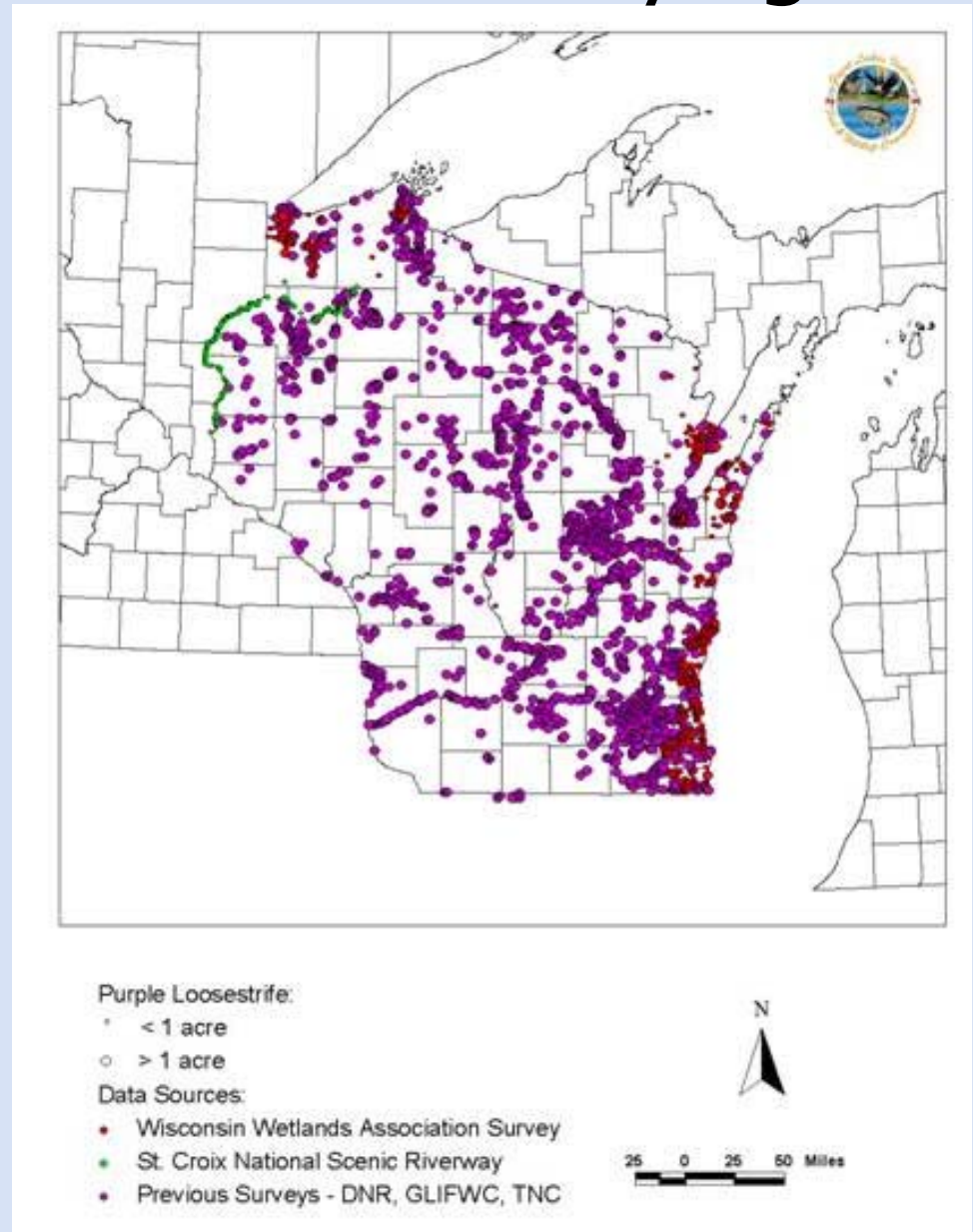
# Wisconsin's PL map (based on 1988 survey)



[WWW.GLIFWC-MAPS.ORG](http://WWW.GLIFWC-MAPS.ORG)

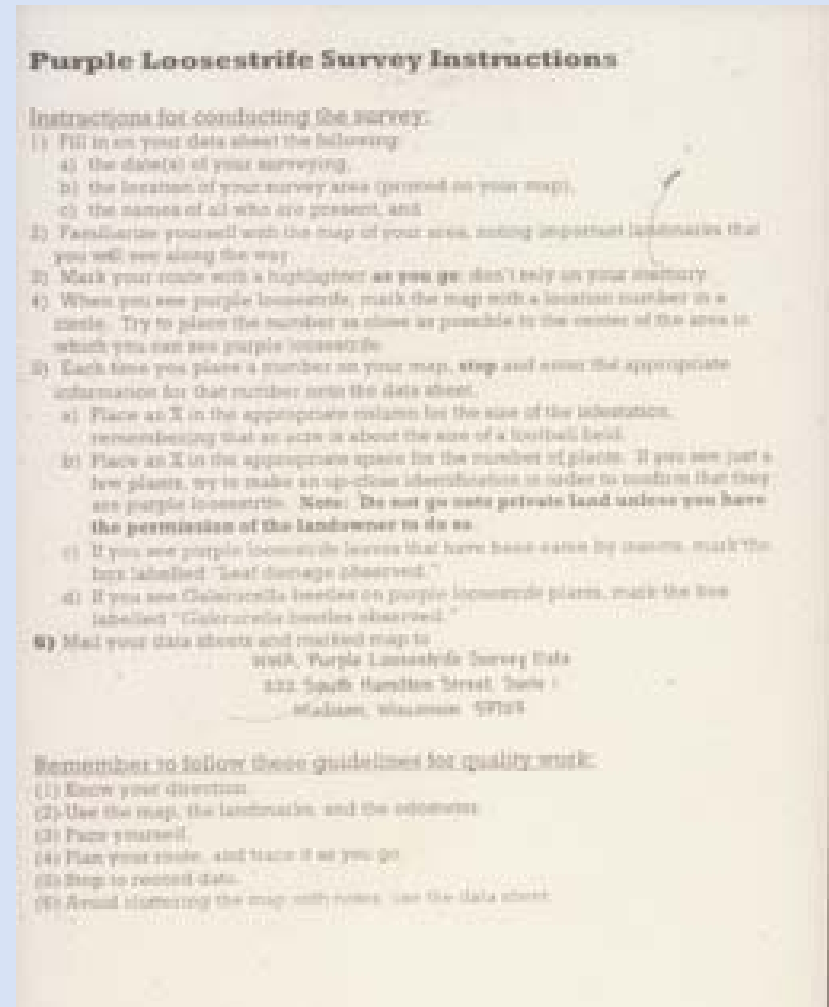
# Importance of Continued Surveying

1. Original survey is not exhaustive
2. New infestations need to be controlled
3. Biocontrol sites are potential beetle-harvest sites



# Basic PL Survey Instructions

- Get a good map.
- Mark your route.
- Number sited purple loosestrife on map.
- Fill in the data sheet.
- Mail surveys to WWA.



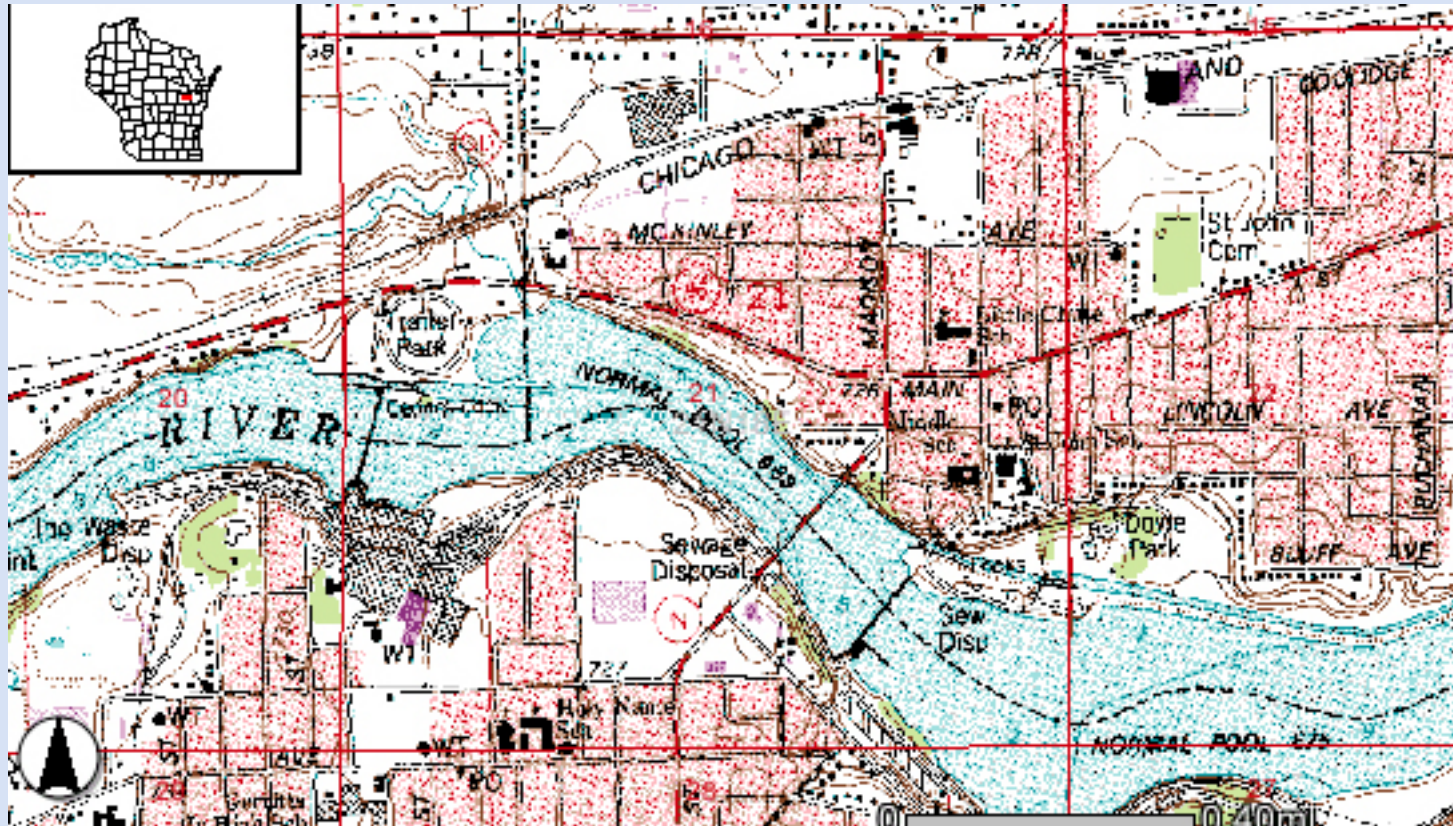
# Sources of Good Maps

1. [WWW.GLIFWC-MAPS.ORG](http://WWW.GLIFWC-MAPS.ORG) –on-line GIS showing existing purple loosestrife information
2. [HTTP://MAPS.DNR.STATE.WI.US/DNRWEBVIEW](http://MAPS.DNR.STATE.WI.US/DNRWEBVIEW) - DNR's on-line mapping application
3. Your county's planning and zoning department
4. County plat book (best if enlarged to 11" X 17")
5. USGS maps:  
[WWW.DNR.STATE.WI.US/MAPS/GIS/datadrg.html](http://WWW.DNR.STATE.WI.US/MAPS/GIS/datadrg.html)
6. Recreational maps from tourism bureaus or outdoor supply stores



# Practical Tip #1

## Use the map and the landmarks.



# Practical Tip #2

## Record data as you go.



> 1 acre infestation  
(1 acre = football field)



©2002 Gary Fewless

< 1 acre infestation





# Participate in a USGS Study!

- USGS study on purple loosestrife growth habits in different latitudes
- Plant height
- Number of stems per plant
- More information at



[www.nwrc.usgs.gov/special/purplel/index.htm](http://www.nwrc.usgs.gov/special/purplel/index.htm)

# Wisconsin's Purple Loosestrife Biocontrol Program



A cooperative venture of WDNR,  
UW Extension and Wisconsin  
Citizens!

# PL Control Methods

- Manual Removal
- Chemical Treatment
- Biological Control



# Prevention by removing young pioneer plants

- Prevent new infestations: remove new plants along roads and waters
- This is the easiest way to control PL spread
- Small, young plants pull with intact root systems





# Manual Removal of Mature Plants

- Often effective for eliminating just a few plants
- Labor-intensive; must remove entire plant and burn or contain in landfill
- Sometimes ineffective due to soil disturbance, which fosters new plants



# Chemical treatment

- Effective only on small areas
- Expensive & time consuming
- Must be done thoroughly and regularly
- Potential ill effects from using pesticides



# Biological Control (Biocontrol)

*The use of “natural enemies” to control populations of an invasive species.*

## **Natural Enemies**

Predators

Pathogens

Parasites

# Biological Control is likely the only true long-term control

- Longer set-up times
- Critical on large sites
- Carefully researched
- Safe and inexpensive
- Self-sustaining





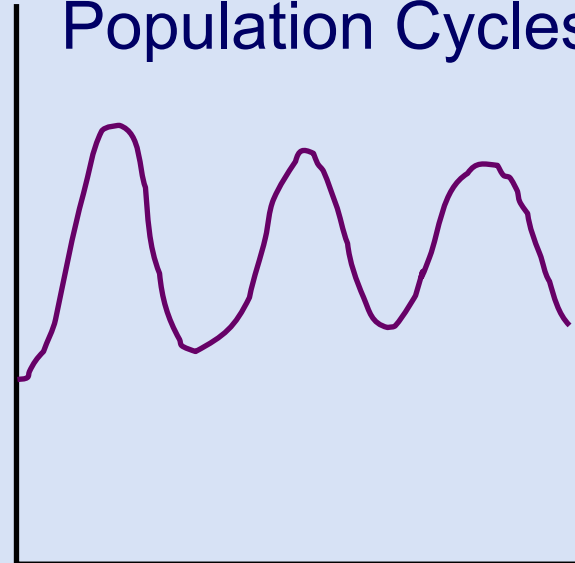
# Population Patterns

## Natives vs. Invasives

Invasive Species:  
Exponential Growth



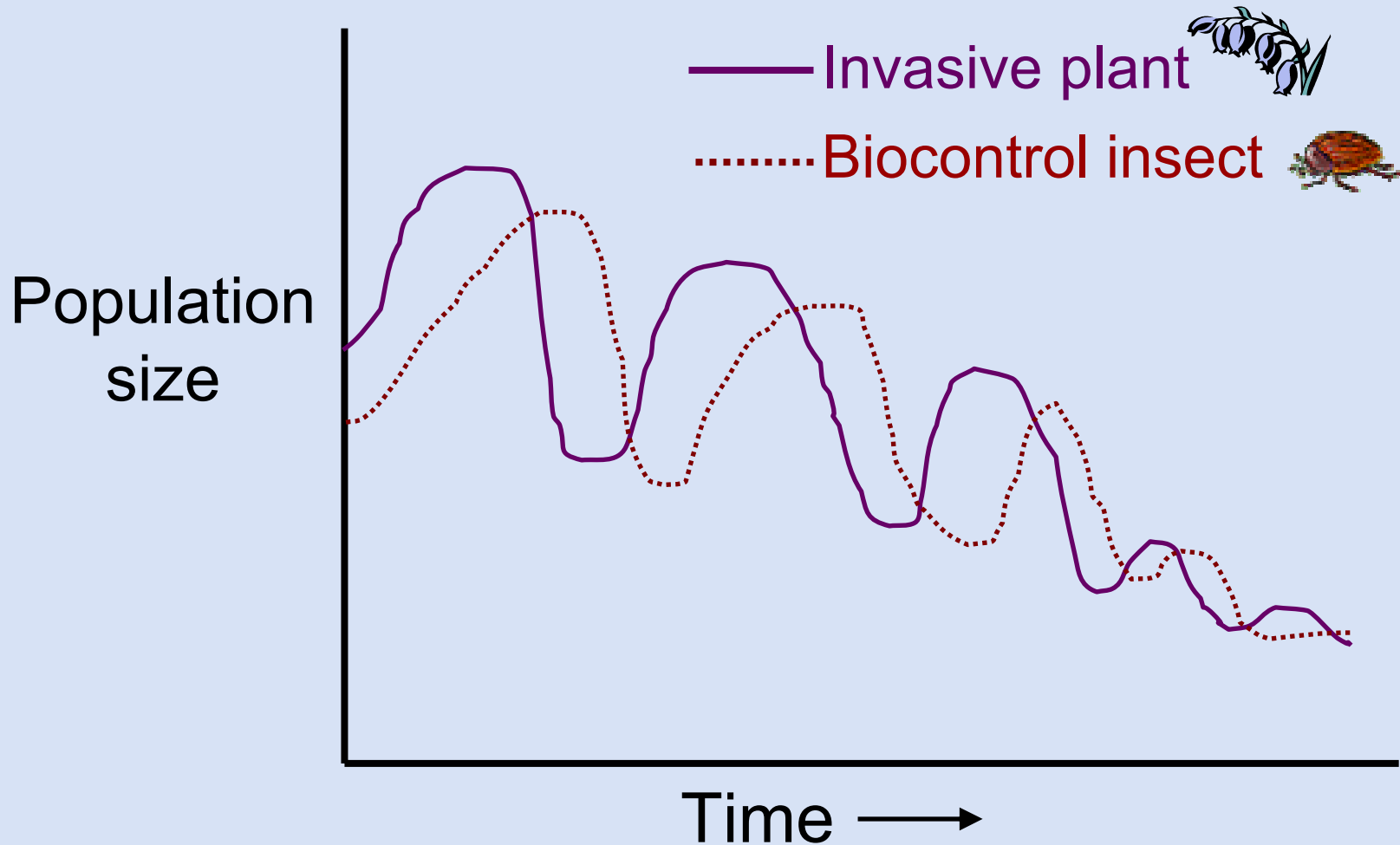
Native Species:  
Population Cycles



Population Controls  
competition  
predation  
disease

# Biocontrol Population Dynamics

what we hope happens over time



# Selecting a biocontrol agent

1. Easy to propagate in large numbers
2. Effective at reducing PL populations
3. Not damaging to other plant species
4. Will not become a pest species

Monophagus- describes an animal that feeds very selectively on just one food item

# Purple loosestrife in Europe

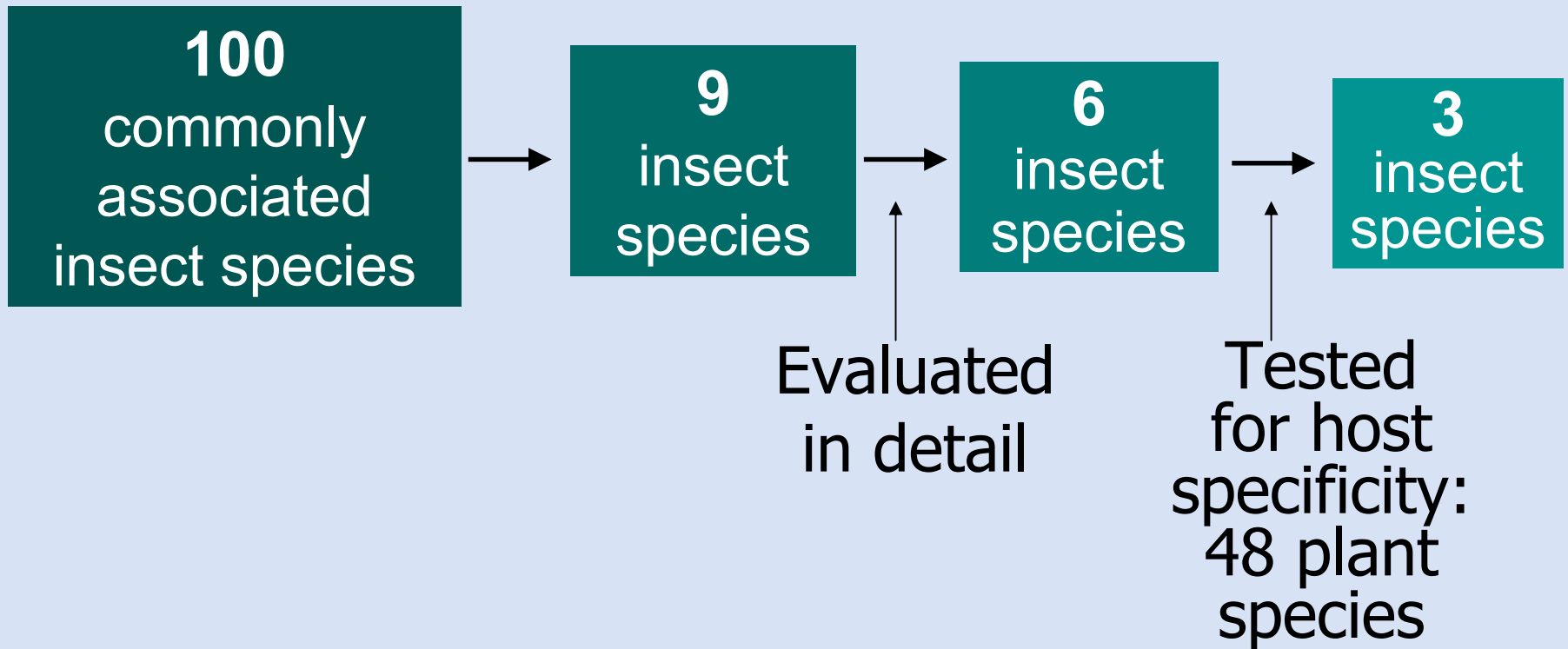
- Native range of PL
- Small patches, does not spread invasively
- Eaten by many kinds of insects





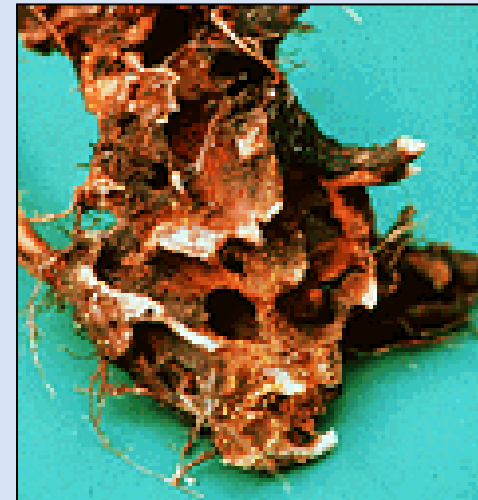
# Research to Select a Biocontrol Agent

Research began in Europe in 1986



# One possible agent: *Hylobius transversovittatus*

- A weevil whose larvae eat purple loosestrife roots, killing the plant
- Difficult to propagate
- Used in small numbers in Wisconsin by DNR



# A Promising Biocontrol Agent: *Gallerucella* ("Cella")

- 2 species: *Galerucella californiensis* and *G. pusilla*
- Larvae feed on flower-forming top of plant, halting seed-production
- Adults and larvae feed on leaves, halting photosynthesis
- Easy to grow thousands in a few weeks



# Research to Select a Biocontrol Agent

## Further Research in U.S.

- Cornell Univ. – 10 years of testing
- All midwestern states did testing
- Wisconsin tested all agricultural plants

## RESULT: Benefits far outweigh risks

- 2 biocontrol beetles introduced in early 90's
- Introduced in at least 16 states
- Over 4 million released so far

# Research Summary

## Is Cella safe for use in biocontrol?

- Q. Will Cella eat beneficial plants?
- A. NO. Lab and field tests confirm.
- Q. Will Cella grow into uncontrolled swarms?
- A. NO. Many predators eat Cella.





# “Cella” life history patterns

- Cella beetles usually emerge in May to mate on PL plants
- Cella beetles over-winter as adults in uplands near wetlands
- They can collect in large numbers on select plants
- In small PL infestations beetles stay concentrated and easy to find



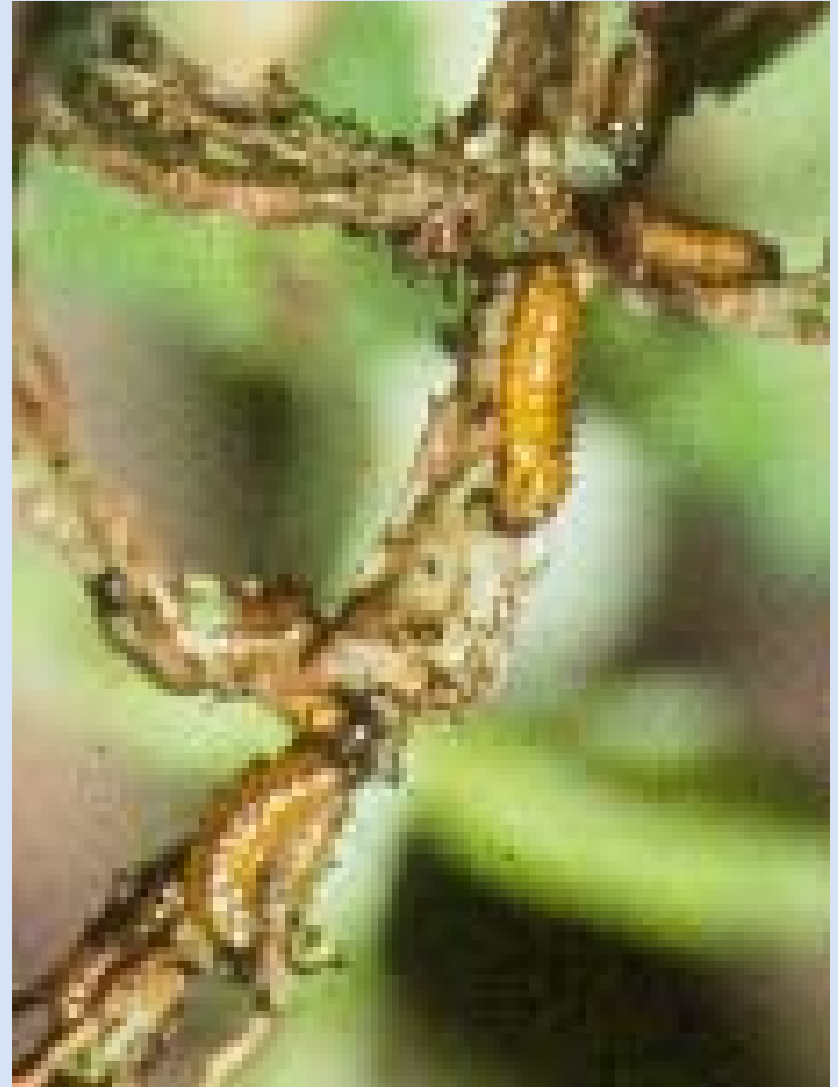
# “Cella” life history patterns

- Cella eggs are laid in leaf axils
- Laid in clusters averaging 5 eggs each
- Eggs are  $\sim 1/16$  inch in diameter
- Eggs always have a black stripe on them



# Cella larvae

- Cella larvae start hatching in 3-4 weeks
- Larvae feed voraciously on leaves and stems
- Defoliate PL plants
- Leaf damage is similar to a leaf miner
- Larvae reach  $\sim 1/4''$  in length



# Typical leaf damage from adults (top) and larvae (bottom)



# Larval feeding prevents flowering





# Effects on PL plants

- Intense feeding may cause a plant to die back for the year
- Beetles will prevent seed production
- PL plants gradually get shorter, allowing other plants to shade it out



# Larvae to Pupae to Adults

- Larvae pupate 2-3 weeks in soil into new adults
- New adults feed to put on fat to live through the winter then leave the wetlands for upland forests
- There is very little first year damage-it starts with 2nd year larvae



# Gradual changes in PL

- Feeding over years gradually reduces PL plant size and seeds
- Current year's plants are shorter than previous year's plants and have fewer and shorter flowers





# Example of PL decline over 4 years

1994 to 1998 at Navarino SWA



# Continual Monitoring

WDNR field research continues to ensure  
the safety of biocontrol





# Advantages of Using Biocontrol

- Inexpensive
- Simple
- Natural
- Non-toxic
- Long-term
- Educational

BEFORE



AFTER



# Rearing PL Biocontrol Beetles

Cella



# A great project for Wisconsin volunteer cooperators of all ages

- Cooperators at Hunters Lake in Waukesha County
- Typical beetle rearing set-up



# Beetle production

1. Potting PL plants
2. Adding Cella beetles
3. Releasing beetles



# Raising Cella, Step One

- Pot purple loosestrife roots in a simulated wetland
- Time: as soon as marsh thaws in spring





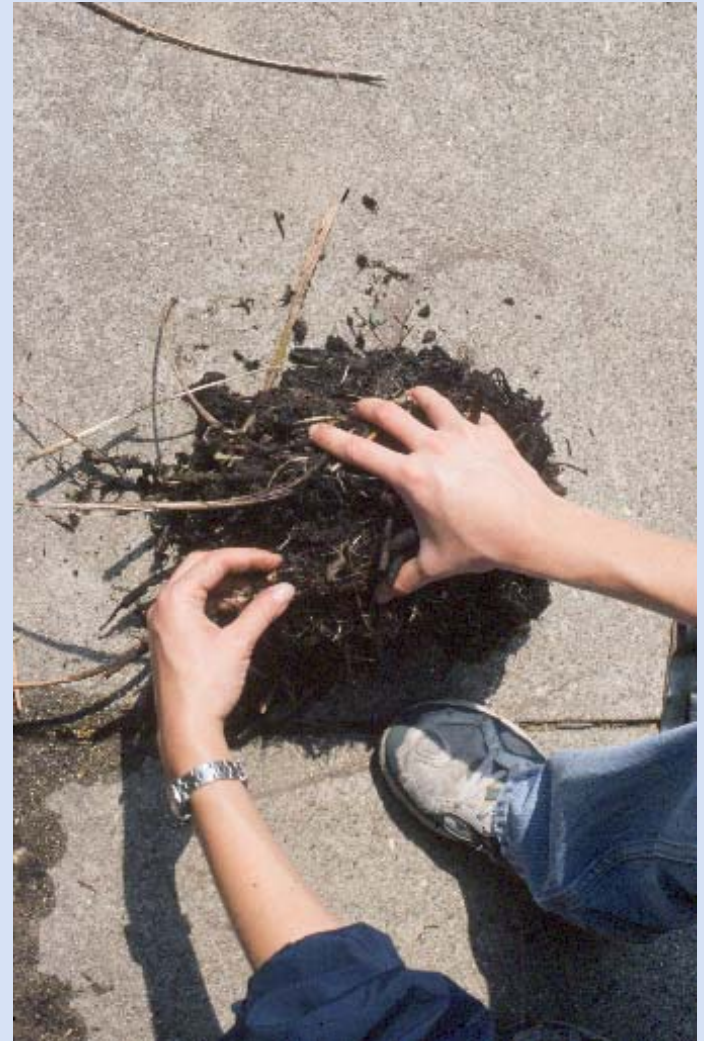
# Collecting PL Roots

- Use gloves and break old stem tops off a PL clump
- Use a fork (to loosen) or shovel (to cut) roots



# 1<sup>st</sup> Root Cleaning On-Site

- Pull off as much organic material as possible, being careful not to harm PL shoots
- This reduces predator & competitor egg load
- Leave all gleanings at the site since all will contain PL seed



# Predators



# Competitors



# Prepare moist potting soil for planting cleaned roots



Large (10"+) pots or 5 gallon buckets with holes are needed





# 2<sup>nd</sup> Root Cleaning at Rearing Site

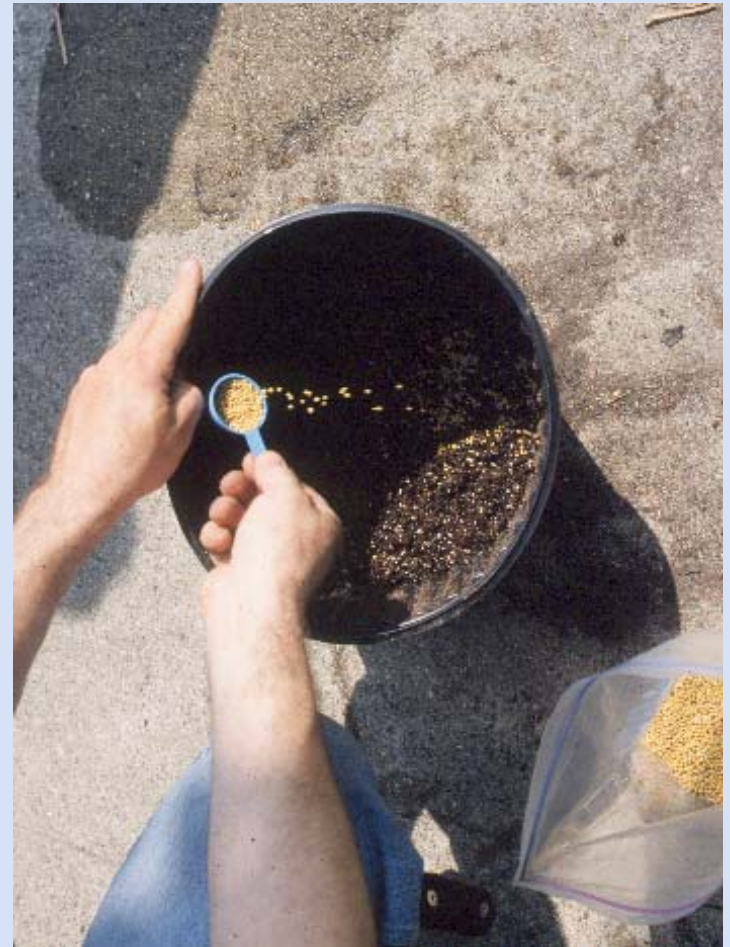
- Hold shoots pointed away from you
- Use hose spray to blast organic material and surface soil off the top of the clump
- Collect material for return to source marsh
- Clean top only





# Potting PL plants

- Put in 2" of potting soil and fertilizer
- Pack as much root material in each pot as possible--with at least 6 new shoots
- Some potting soil already has fertilizer
- Keep topping soil packed loosely



# Put cages on newly potted PL roots immediately

- This keeps plants predator and competitor free
- Even if the cages have drawstrings, secure them with duct tape



Put pots into watered pools in full sun and suspend cage tops



# Examples of cage suspension:

Summer camp



Rotary Club





# When plants are 1 foot tall, clip shoot tips to force lateral growth

- Find and clip just the tiny growing point buried in the tip leaves of each healthy shoot
- Lateral shoots will then grow and produce more foliage for the beetles, and fewer flowers



# Raising Cella, Step Two

- Place Cella beetles on plants
- Time: as soon as plants are 2 feet tall





# Beetles will be collected in May by WDNR staff and volunteers



Beetle delivery day near Oshkosh  
when cooperator plants are 2' tall



# Check plants with little damage

Little damage may be due to:

- Too few female beetles
- Holes in the cage or
- Presence of predators or competitors





# Raising Cella, Step Three

- Release beetles into wetlands by leaving the whole plant and pot
- Time: when the beetles begin to exhaust their food supply



# Release site choice is important and should be done early

- Choose sites before new beetles need to be released
- Large sites have no other effective control
- Look at GLIFWC's maps online for sites



# Timing of beetle release

- Beetles must be released once all PL leaves are gone
- No food and high temperatures kill beetles
- Release before new adults emerge
- Early released beetles usually do well





# Look for new adult beetles

- When new adult beetles appear in a cage move that pot very soon
- New adults are tan
- All old, dark brown adults should be dead
- Most new adults will emerge over following weeks in the new site



# Girl Scouts in Madison carry pots to their release site



Place each pot next to a healthy,  
vigorous PL field plant



# Remove the cage from each field-released potted plant

- Leave the pot in place to protect beetle pupae in the soil-collect later
- Entwine stems of the released and healthy plants





Shake all beetles off the cage  
onto PL plants at the site



# Document the starting conditions

Photograph your site from a marked point  
at maximum flowering this summer





Return to the site at the same time every year to see changes!



Henrietta Lake 5 years after beetle release

Count beetles in spring to see  
population change



# This program has great potential for education

- Here teachers learn about a PL beetle release site near Iola
- They are exploring how to raise beetles and use the process at their schools





# Beetle work in wetlands gives students personal involvement

- Hands-on work is what creates real environmental citizens
- The care of wetlands today is not a matter of wetlands, but of the human heart...



# For More Information

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# Special Thanks to WWA's Supporters

- Wisconsin Coastal Management Program
- Wisconsin Department of Natural Resources
- Great Lakes Indian Fish and Wildlife Commission
- UW-Extension
- Great Lakes Protection Fund





*Photo by Joan Haasl*